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**AUSTRALIA  
Patents Act 1990  
PROVISIONAL SPECIFICATION  
FOR A PROVISIONAL PATENT**

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**Invention Title: Multipoint Fasteners And Releaseable Fastening System**

**The following statement is a description of this invention**

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In a first aspect, this invention relates to a multipoint fastener.

In a second aspect, this invention relates to a releasable fastening system which is a variation on that described as the third aspect of Australian Provisional Application

5 No. 2003906324, the contents of which are imported herein by reference.

Specification No. 2003906324 referred, in turn, to an Australian Provisional Patent Specification No. 2003905644 and the contents of the latter are also imported herein by reference.

In a third aspect, this invention relates to a fastening system using a type of torque

10 means, similar to that described in 2003905644.

In relation to the first aspect, there have been disclosed in earlier patent specifications various types of fasteners, which may be actuated remotely (by radio frequency, infrared, etc.) or by hard wiring. The invention in its first aspect refers

15 to any suitable prior art fastener. Some non-limiting examples are the fasteners disclosed in the following patent specifications, the contents of which are hereby imported herein by reference (unless already done so above): Fixing and Release Systems: International Patent Application No. PCT/AU/99/00185, Improvements in Fixing and Release Systems: International Patent Application No.

20 PCT/U/03/00759, Improvements in Assembly: International Patent Application No. PCT/AU/03/00933, Bolt Assembly: International Patent Application No.

PCT/AU/03/01539, Fastener for Airbags and Other Uses: Australian Provisional Patent Application No. 2003901352, Releasable Fasteners: Australian Provisional Patent Application No. 2003902993, Fastener: Australian Provisional Patent

25 Application No. 2003905644, Improved Framing System: Australian Provisional Application No. 2003906324, Further Improvements in Releasable Fasteners: Australian Provisional Application No. 2004900529.

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The invention, in its first aspect, provides a fastening system which includes two or more fasteners, each fastener adapted to be locked or unlocked upon receipt of a suitable signal, wherein the two or more fasteners are included in a single carrier.

The invention is based on the concept that many of the fasteners referred to above and in the specifications incorporated herein by reference can be provided in groups of fasteners. The fasteners may be arranged in a single plane, in two planes, or in three planes.

The fasteners in each carrier may be identical or they may differ one from another. When the fasteners are arranged in a single plane, they may adopt any desirable pattern. When the fasteners are arranged in two or three planes, there may be one or more fasteners in each plane. When there is more than one fastener in each plane, once again they may be arranged in any suitable pattern.

The fasteners may be adapted to be locked or unlocked upon receipt of the same signal, or different signals. For example, one fastener may be adapted to unlock upon receipt of a magnetic signal, whereas a neighbouring fastener in the carrier may be adapted to be unlocked upon receipt of an infrared signal.

The fasteners may be locked or unlocked upon receipt of the same type of signal, such as an electric signal, but the fasteners may be addressable individually as already disclosed in one or more of the specifications referred to above.

20 Preferably, all fasteners in a single carrier are connected to a single command source or there is a common electronic arrangement hosting all the fasteners. This can provide optimum efficiency and minimum cost in relation to groups of fasteners.

If desired, the fasteners in question may be the type where locking occurs without 25 the need for activation of the fastener - for example, the type of fastener illustrated in Figures 10 to 12 of Provisional Application No. 2003906324. This type of

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fastener can greatly facilitate attachment of objects or parts to be fastened, yet provide the required security since release or unlocking is dependent on the receipt of a suitable signal.

As one example of application of this first aspect of the invention, the fastening system can be used to great effect in aircraft interiors where seats, shrouds, interior lining, etc., require a large number of fasteners. Using the fastening system of the invention can enable rapid exchange or replacement of these parts.

In its second aspect, the invention is concerned with a releasable fastening system including a pin adapted to be received in an aperture, the system including means associated with the aperture for locking or unlocking the pin, the means including a material adapted to contract when activated to unlock the pin. This was disclosed in Application 2003905644.

A modification of this invention was disclosed in Application 2003906324, in which the pin included a groove around all or part of its circumference. The groove was adapted to receive a locking means in the form of a collar, at least part of which could enter the groove. The material adapted to contract when activated was attached to the collar to move it out of engagement with the groove when activated and so permit release of the pin. The collar could be a type of circlip.

In this second aspect of the invention, a further variation on the circlip or collar is disclosed in two versions. In one version, the circlip includes a clip spring and a clip chassis. In the other version, the clip chassis is eliminated.

In the third aspect the invention represents a modification of a fastener using the torque means described as the sixth aspect of the invention in No. 2003905644, providing a releasable fastening system which is a modification or variation on that described in the sixth aspect of Australian Provisional Patent Specification No. 2003905644. The torque means of the sixth aspect had a fixed body and a rotatable body, first material adapted to contract when activated wound around the

fixed body and attached to the rotatable body and second material adapted to contract when activated wound around the rotatable body and attached to the fixed body. The present invention in the third aspect is a modification or variation which uses rotation of one body relative to another when the material adapted to contract when activated wound around the rotatable body is caused to contract.

The invention will now be described in relation to certain non-limiting examples thereof described in connection with the accompanying drawings, in which:

10      **Figure 1 is a perspective view of a first embodiment of the invention in the first aspect;**

15      **Figure 2 is a perspective view of a second embodiment of the invention in the first aspect;**

20      **Figure 3 is a perspective view of a third embodiment of the invention in the first aspect;**

25      **Figure 4 is a perspective view of a fourth embodiment of the invention in the first aspect;**

30      **Figure 5 is an exploded view of an embodiment of the invention in the second aspect;**

35      **Figure 6 is an enlarged detail of the embodiment of Figure 5;**

40      **Figure 7 is an exploded view of the first embodiment of the invention in the third aspect;**

45      **Figure 8 is a top view of a variation of the embodiment in Figure 7;**

50      **Figure 9 is a cross-sectional view of the embodiment of Figure 8, taken along the lines A-A of Figure 8;**

Figure 10 is a top view of a further embodiment of the third aspect of the invention; and .

Figure 11 is a cross-sectional view of the embodiment of Figure 10 taken along the lines A-A of Figure 10.

- 5 Turning first to Figure 1, fastening system 10 has three fasteners, arranged in a straight line. The outer two fasteners 12 are of the same type. The centre fastener 14 is a different type from the outer two fasteners. The three fasteners are included in a single carrier 16 and lie on a single face 18. The fasteners may be chosen from any suitable type of fastener, including those discussed earlier.
- 10 In relation to Figure 2, fastening system 20 has fasteners on two faces, 24 and 26. Face 24 has three fasteners, two type-12 fasteners and one type-14 fastener, in a single row. Opposite face 26 of carrier 22 has an identical three fasteners.

In Figure 3, fastening system 30 has four type-12 fasteners arranged at the corners of a square on face 32. Carrier 28 in this embodiment has the fasteners on face 32 only. In a modified embodiment, carrier 28 could have fasteners on the face opposite to face 32 or could carry one or more fasteners on, for example, faces 34 or 36. Fasteners on face 32 lie in one plane, while one or more fasteners on face 34, for example, would lie in a perpendicular plane to that on face 32.

With reference to Figure 4, fastening system 40 has three type-12 fasteners on carrier 38. One fastener 12 is on face 42, another fastener 12 is on face 44 and a third fastener 12 is on face 46. This illustrates an embodiment of the invention where the fasteners are in three planes.

As will be readily appreciated, the types of fasteners in the embodiments in Figures 1 to 4 may be readily mixed.

25 Referring now to Figure 5, releasable fastening system 50 includes a pin 52 adapted to be received in an aperture 54 of main body 56. Clip spring 58, together

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with clip chassis 60 and shape memory alloy wire 62, together comprise means associated with aperture 54 for unlocking pin 52.

Pin 52 has a wide groove 63 around its circumference. Groove 63 is adapted to receive clip chassis 60 which can embrace the groove 63. Clip chassis 60 acts as a  
5 type of circlip.

Shape memory wire 62 is engaged with clip chassis 60 in the manner shown in Figure 6. When shape memory alloy wire 62 is activated, it shrinks and pulls apart clip chassis 60.

To lock pin 52 into main body 56, pin 52 may be pushed by hand, by pressure on  
10 cap 64, into aperture 54. Clip chassis 60 and clip spring 58 open sufficiently to allow pin 52 to be received, so that clip chassis 60 engages groove 63 on pin 52.

To unlock pin 52 from main body 56, as already described, wire 62 is heated sufficiently for it to contract. Because of the manner of attachment of wire 62 to clip chassis 60 (refer Figure 6) through engagement in channels 66 and 70,  
15 contraction of wire 62 pulls apart clip chassis 60 sufficiently for pin 52 to be withdrawn from clip chassis 60.

Fastening system 50 includes controller panel 72 which receives instructions for unlocking and which generates the heat necessary for contraction of wire 62. Rear cover 74 completes the housing of fastening system 50.

20 Clip spring 58 biases clip chassis 60 towards the locked position and in this embodiment assists wire 62 to return to the locked position when it relaxes.

In a variation of fastening system 50, clip chassis 60 may be eliminated. In this case, clip spring 58 is adapted to be engaged by shape memory alloy wire 62 and to be pulled apart by contraction of the wire when it is desired to unlock the fastening  
25 system.

Referring now to Figures 7, 8 and 9, the stud fastening system 80 in this embodiment is particularly suitable for heavy duty use. In this embodiment, pin 82 having groove 84 and cap 86 is adapted to be received in aperture 88 of main body 90. Received in main body 90 is shuttle 92. Shuttle 92 is adapted to rotate within main body 90 when a shape memory alloy wire (not shown) wound in grooves 94 contracts. The mechanism in this regard is similar to that illustrated in Figures 11, 12 and 13 of Application 2003905644. Activation of the shape memory alloy wire causes shuttle 92 to rotate in a direction which allows unlocking of fastening system 80.

- 10 Shuttle 92 includes projections 96 which are designed to engage feet 98 of teeth 100. Projections 96 may be inclined as shown in Figure 7 or may be set an angle of approximately 45 degrees as shown in Figure 9.

Washer 102 rests at the base of feet 98 when fastening system 80 is assembled. Small coil springs (not shown) are mounted in apertures 104 and bear against washer 102 to apply pressure against teeth 100. Apertures 104 are formed in centre plug 106. Aperture 108 is designed to receive a further bias spring (not shown), which assists in returning wire 62 to its relaxed configuration, when no longer activated.

Electronics module 110 is shown in this embodiment as being hard wired through cable 112 and controls unlocking of fastening system 80. End cap 114 completes the assembly.

In the variation shown in Figures 10 and 11, main body 90 is shown with a screw thread 116 on which is received a nut 118. The purpose of nut 118 is to allow an element, such as a panel (not shown), to be received in gap 120.

- 23 End cap 114 has a central aperture (not shown) through which it is possible to insert an appropriate tool to rotate shuttle 92 manually in the event that there is some malfunction of fastening system 130.

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It will be noted from Figure 11 that washer 102 has been omitted and that teeth 100 are of a slightly different configuration to those in Figure 9.

It will be appreciated that the embodiments described herein are illustrative only and that other expressions of the invention in its various aspects may be made  
5 without departing from the spirit and scope of the invention.

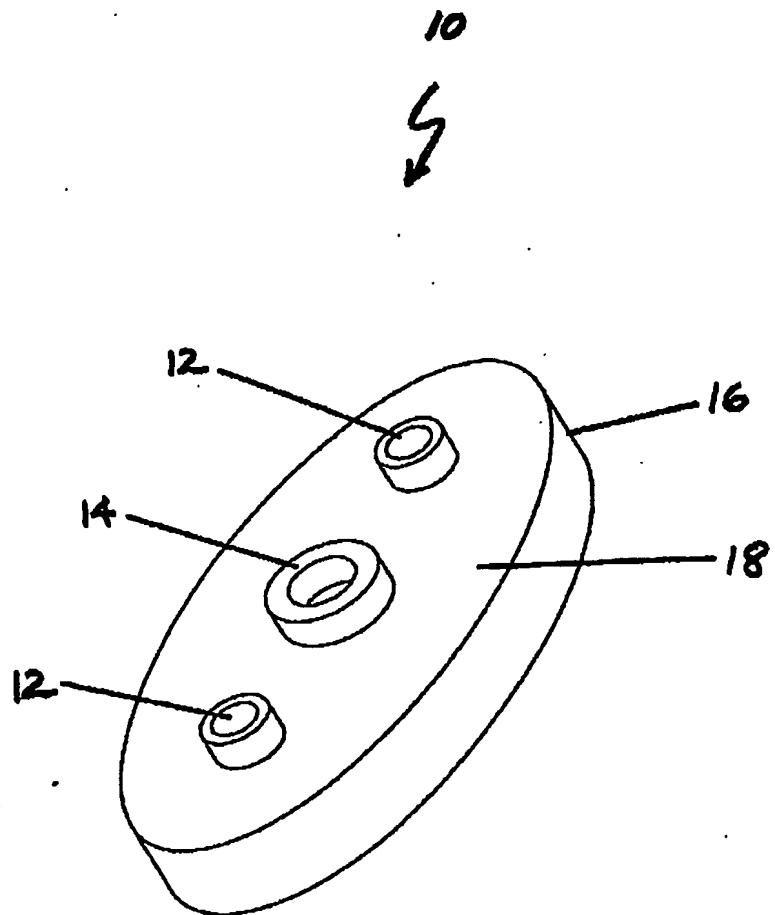
Dated this 16<sup>th</sup> day of March, 2004

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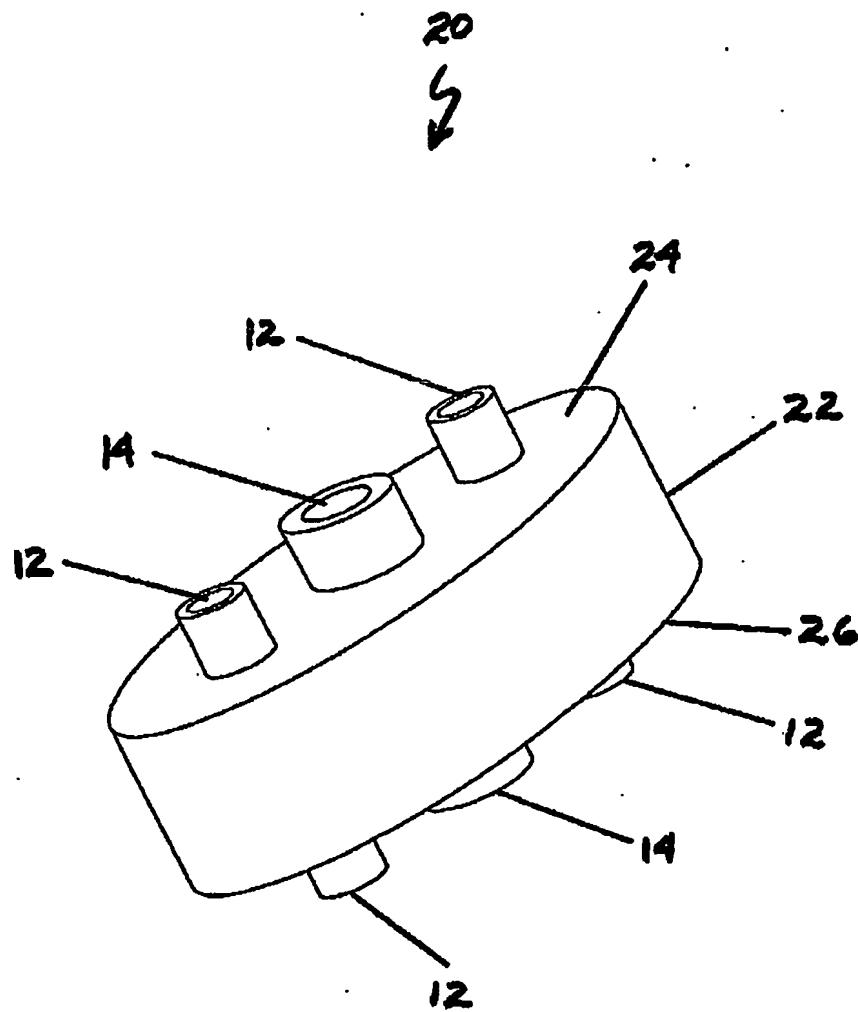
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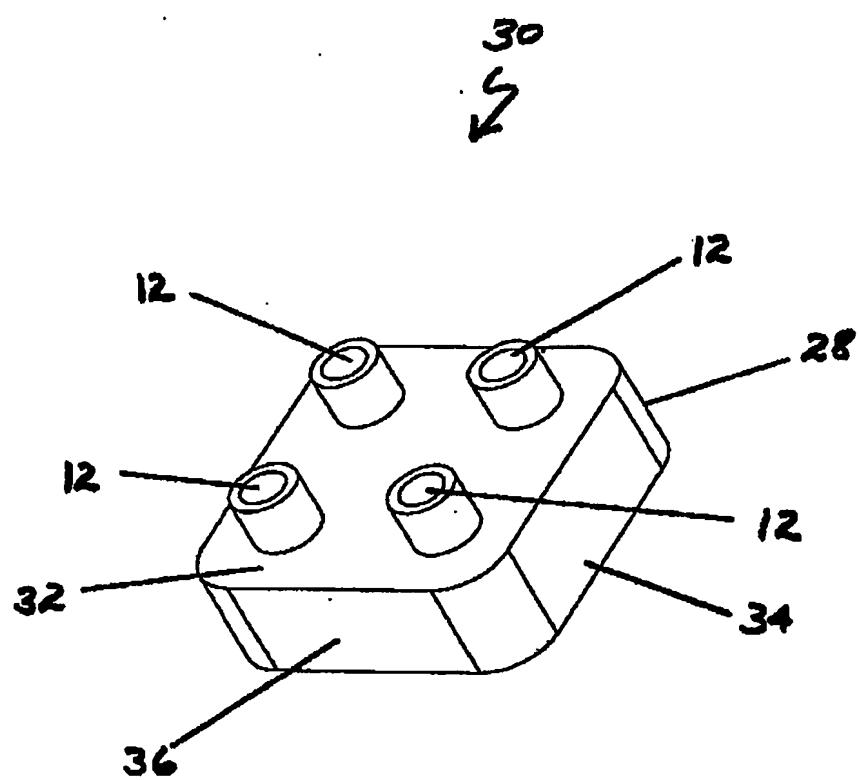
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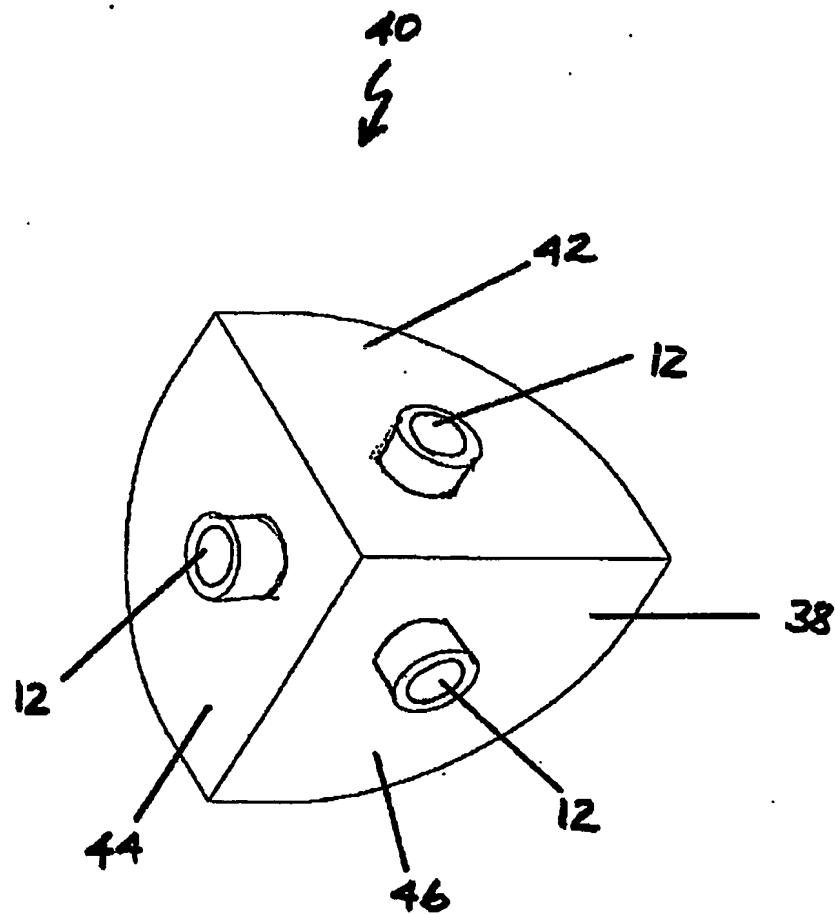


**FIGURE 1**



**FIGURE 2**

**FIGURE 3**



**FIGURE 4**

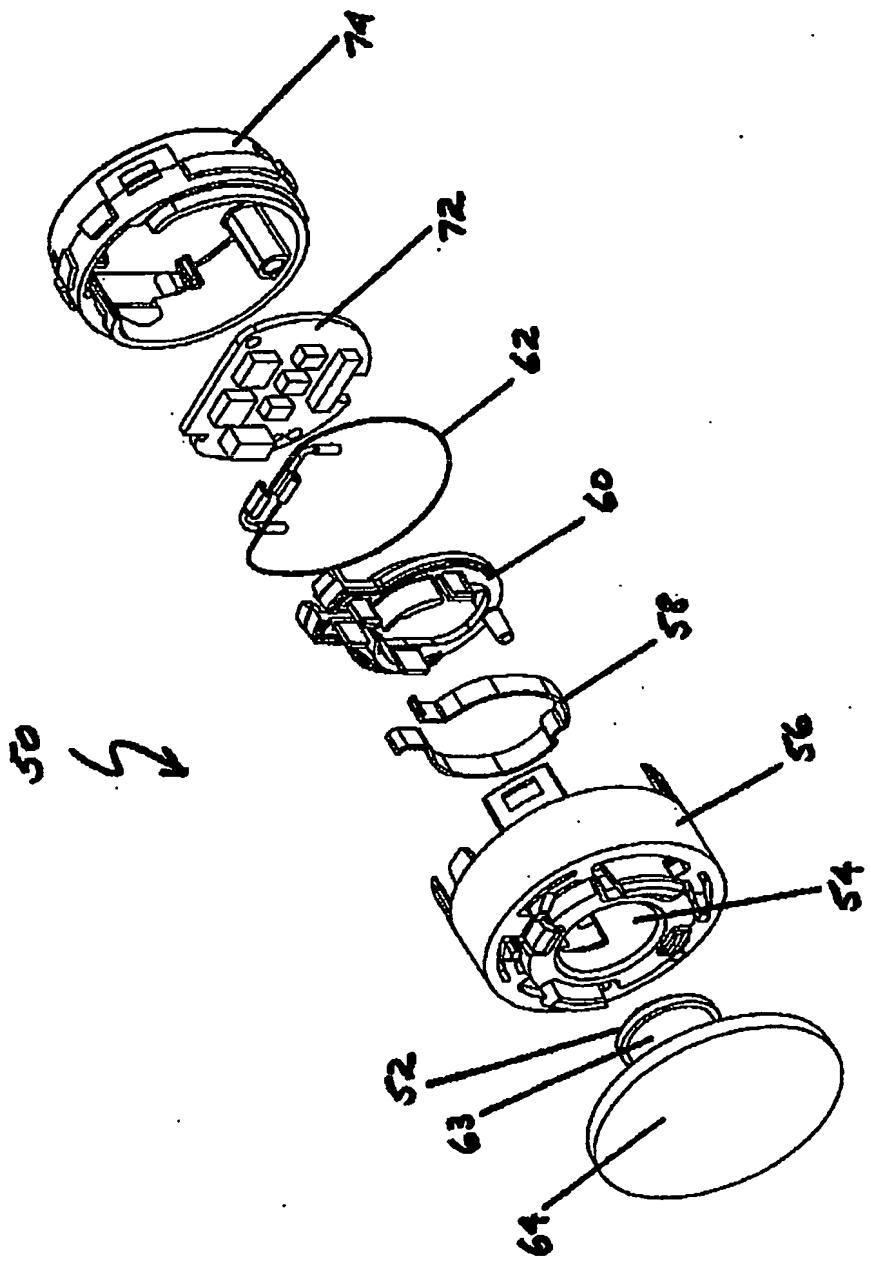
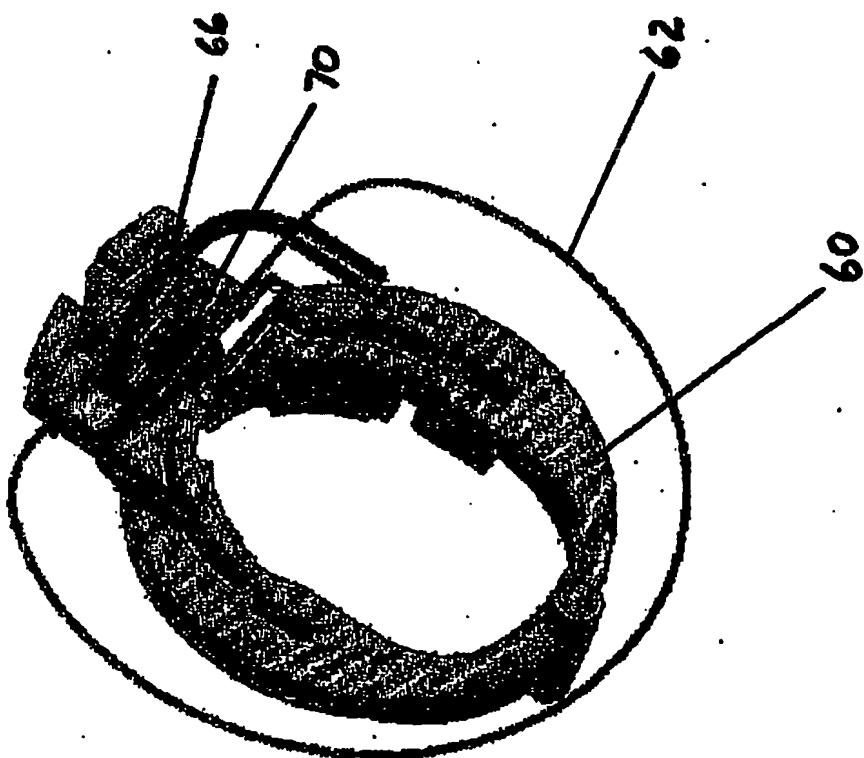
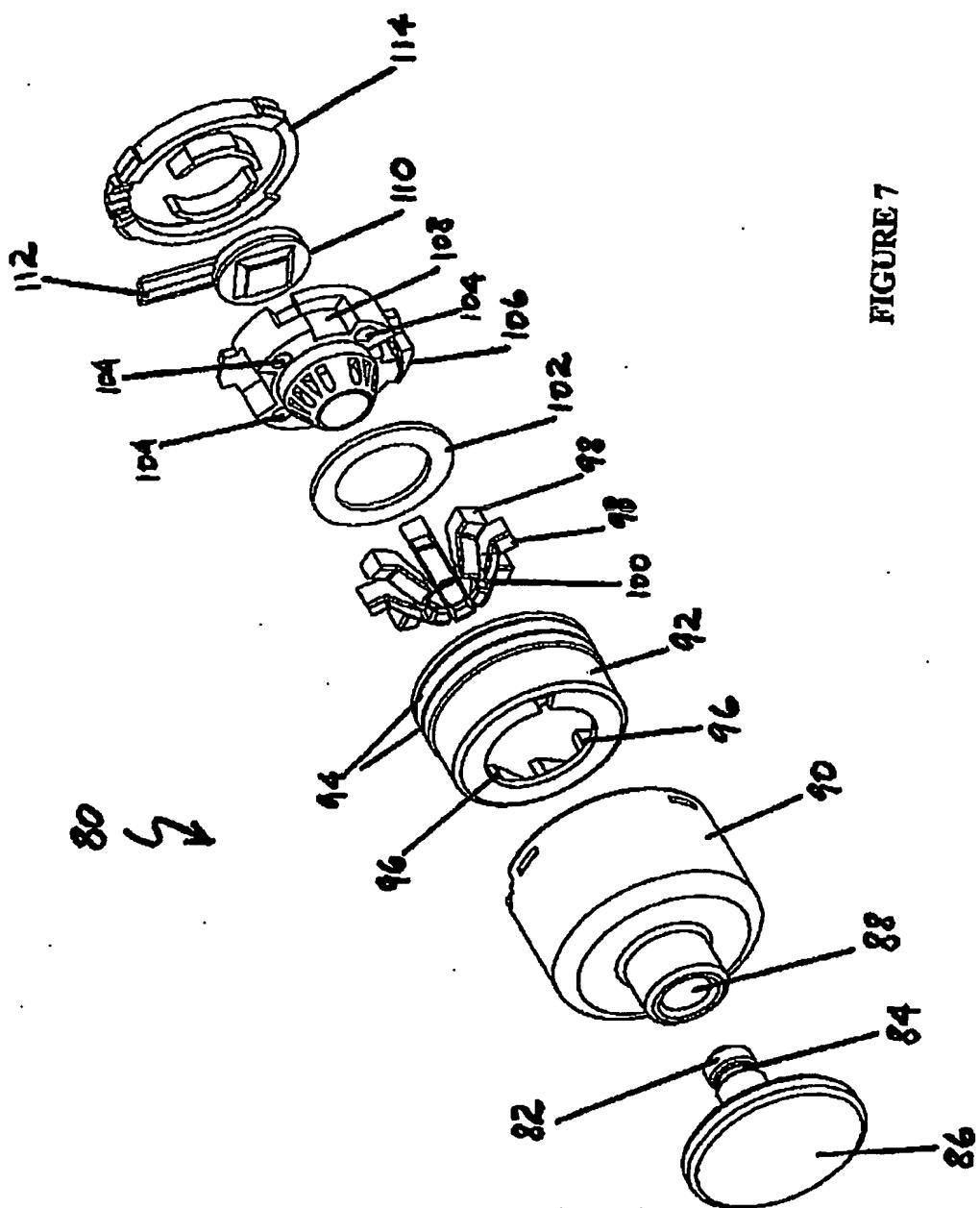


FIGURE 6





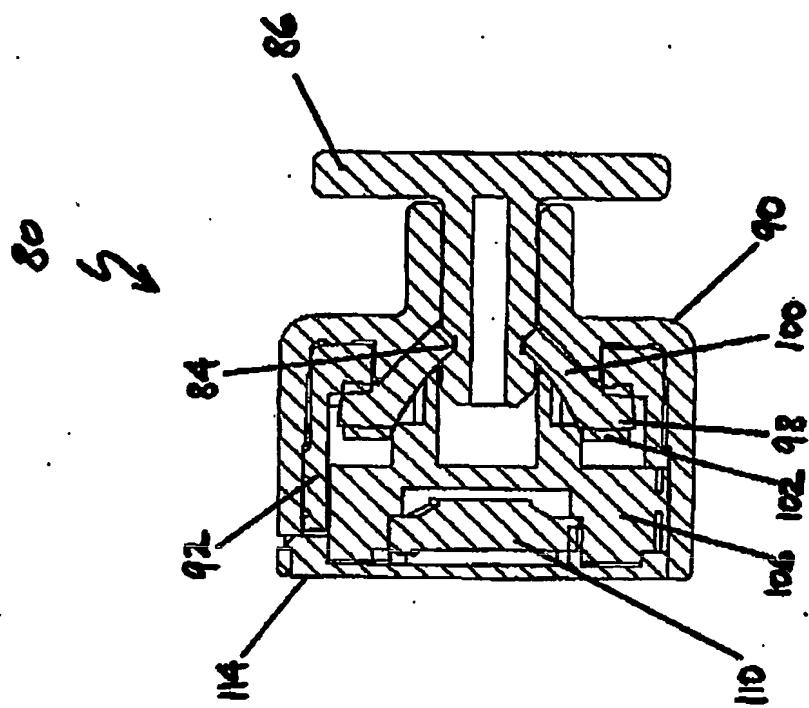


FIGURE 9

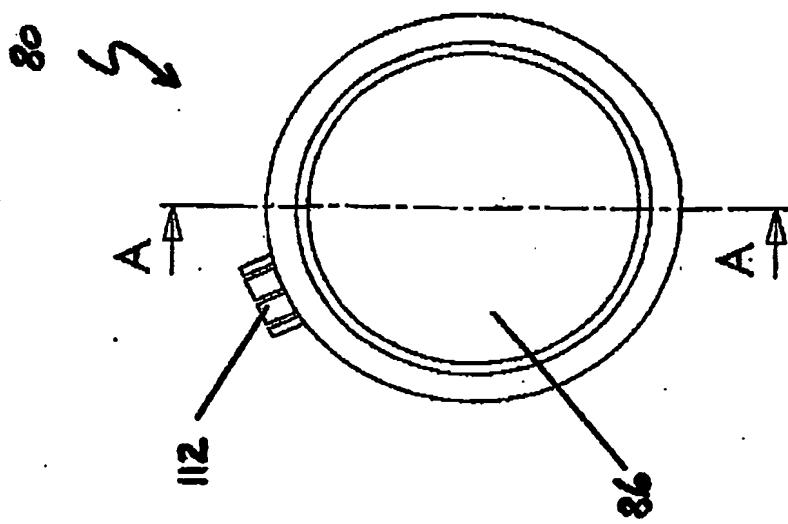


FIGURE 8

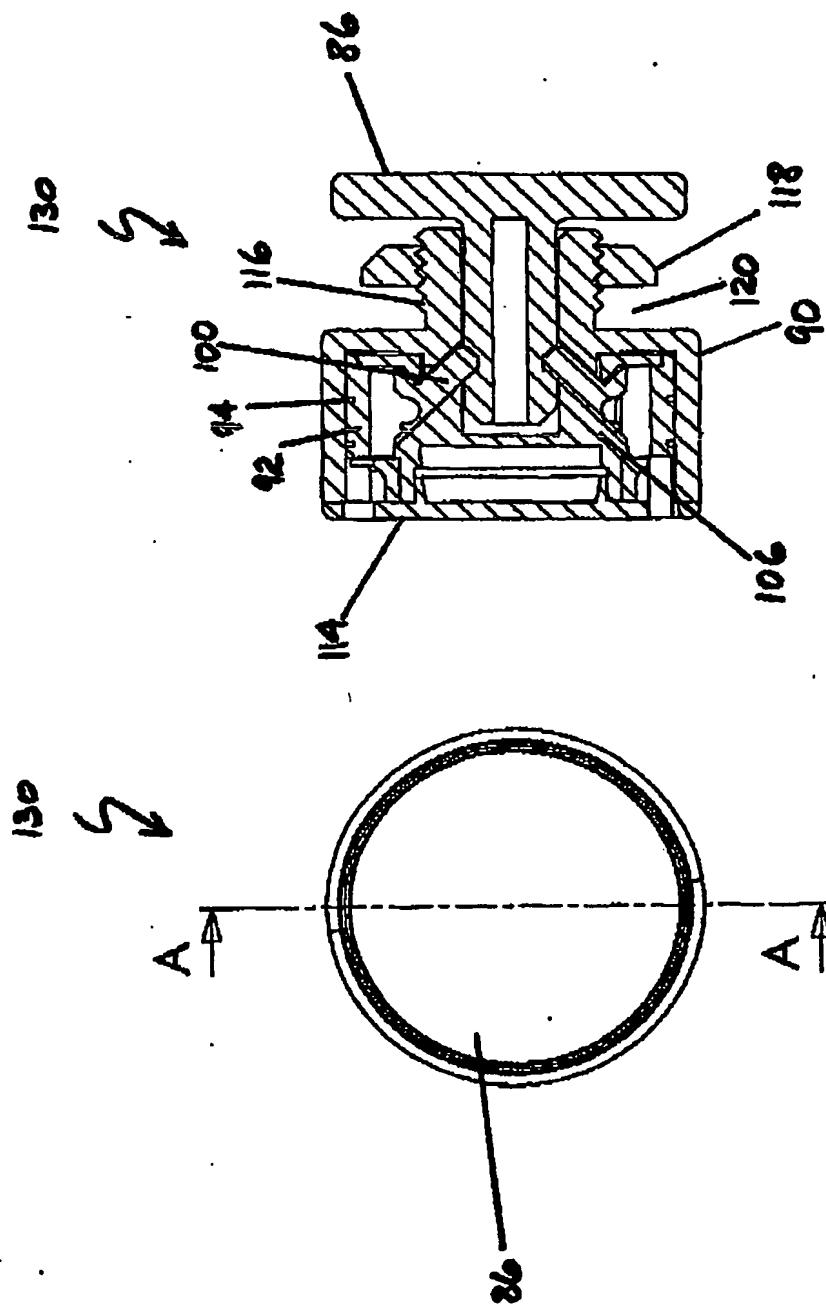


FIGURE 11

FIGURE 10

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